

Division 8
Miscellaneous Construction

Communication Cables and Interfaces

(September 5, 2013)

Materials

Interfaces

Fiber Optic Distribution Panels

The fiber optic distribution panel shall be rated by the manufacturer as a fiber optic distribution panel. The distribution panel shall be designed to hold, at a minimum, the specified number of interconnection sleeves and splice trays. The splice trays and the fiber optic interconnection sleeves shall be fully enclosed on all sides by the distribution panel when the distribution panel is closed.

Each distribution panel shall be fully populated with interconnection sleeves. Interconnection sleeves shall contain zirconium (ceramic) linings (phosphorus bronze is not allowed). All unutilized interconnection sleeves shall have protective dust covers installed.

The distribution panels shall be EIA 19-inch (ANSI/EIA RS-310-C) rack-mountable, unless otherwise noted.

Mounting plates for interconnection sleeves shall be constructed of metal. Adequate spacing shall be provided around each interconnection sleeve. Where interconnection sleeves are arranged in a vertical line, the minimum horizontal center-to-center spacing shall be 1.25 inches (31mm), and the minimum vertical center-to-center spacing shall be 0.625 inches (16mm). Where interconnection sleeves are arranged in a staggered layout, the minimum center-to-center radial distance between sleeves shall be 0.875 inches (22mm).

A wiring diagram shall be supplied with each distribution panel. The wiring diagram shall identify each fiber terminated in the distribution panel using the fiber optic cable labeling method as specified later in these provisions. The wiring diagram shall be placed in a plastic sheet protector next to the distribution panel.

Fiber Optic Connector

Unless otherwise noted in the Plans, all fiber optic connectors used on this project shall meet the following:

- All shall be FC/UPC (55dB) in accordance with Telcordia GR-326
- All shall be factory-connectorized

Fiber Optic Cable Lubricant

Fiber optic cable lubricant shall be as follows:

- Compatible with the cable jacket
- Non-combustible
- Water-based, leaving little or no residue

1 Fiber Optic Splice Closure

2 All fiber optic splice closures shall be re-enterable and reusable and be designed for
3 use on fiber optic cables in an underground, submerged environment. All splice closures
4 shall be rated for 1310 and 1550 nanometer wavelengths. Splice closures shall contain
5 a valve to allow pressurization of the housing.
6

7 Copper Cable Protector Block

8 Copper cable protector blocks shall have the following:
9

- 10 1. A combination connection/protector stubless, with bifurcated quick-clip terminals
11 block for the protection and termination of an OSP cable.
12
- 13 2. Twenty-five solid state type protector units, with gold pins, for the low voltage heat
14 coil.
15
- 16 3. The Contractor shall provide the termination block one type R66B 25-pair
17 stubless bifurcated quick clip terminal for each TWP cable and one for every
18 three 6 TWP cables. One more shall be mounted on a backboard in the cabinet.
19
- 20 a. Each block shall contain 50 rows with six clips each.
21 b. Each row shall be clearly and permanently marked with the number of the
22 cable pair which is attached.
23 c. Within each row the clips shall be electrically connected within the block so as
24 to form two sets of three adjacent clips.
25

26 Copper Cable Termination Blocks

27 Copper cable termination block units shall have 25-pair bifurcated quick clip termination
28 blocks.
29

30 **Construction Requirements**

31 Submittals

32 Within a minimum of 30 calendar days prior to anticipated construction, the Contractor
33 shall provide all documentation pertaining to the materials and method of execution
34 proposed to satisfy the requirements of this section. The Engineer's approval is
35 required prior to the committing of any materials or the commencement of any work.
36
37

38 The Engineer shall either approve or disapprove each submitted item within 30 calendar
39 days of submittal subject to the completeness of the Contractor's submittal. Actual
40 elapsed time for the Engineer's review is dependent upon the completeness and
41 appropriateness of the documentation being submitted. Any deficiencies in the
42 Contractor's submittals shall require additional time for approval. Any delays caused by
43 such deficiencies shall not be grounds for extension of project consideration dates. The
44 Contractor shall anticipate review intervals and schedule submittals accordingly to
45 ensure project progress in accordance with Section 1-08.3.
46

47 The Engineer's approval of any submitted documentation shall in no way relieve the
48 Contractor from compliance with the safety and performance requirements as specified
49 herein.
50

51 Submittals required by this item shall include, but not be limited to, the following:
52

1. A material staging plan, should the Contractor propose Contracting Agency owned property as a staging area.
2. Manufacturer's complete specifications for all communication system cables and, associated electronics and hardware components.
3. Manufacturer's complete specifications for twisted-pair cable splice enclosures.
4. A detailed fiber optic and twisted-pair cable installation procedure including the following:
 - a. Fiber optic cable cutting lengths reflecting the cable order and reel allocations.
 - b. Cable pulling plan which shall state the exact operational procedures to be utilized and which identifies the physical locations for equipment placement, proposed equipment setup at each location, pulling tension on all cables for each pull, staffing, and the pulling methodology for each type of cable.
 - c. Exact splice points as provided for herein.
 - d. Workforce proposed for all equipment, safety, and manual assist operations
5. Factory test data sheets for each reel of cable delivered.

Cable Installation - General

The Contractor shall determine a suitable cable installation method to ensure that all cable installation requirements shall be met in all conduit sections. All work shall be carried out in accordance and consistent with the highest standards of quality and craftsmanship in the communication industry with regard to the electrical and mechanical integrity of the connections; the finished appearance of the installation; as well as the accuracy and completeness of the documentation.

The Contractor shall make a physical survey of the project site for the purpose of establishing the exact cable routing and cutting lengths prior to the commencement of any fiber optic work or committing any fiber optic materials. Splicing is only allowed for the programmed connection of reels and as shown in the Plans to connect a lateral fiber optic cable to the mainline distribution fiber optic cable. The Contractor shall submit a cable routing plan that shows the locations of all splices. All splice locations other than those shown in the Plans must be approved by the Engineer.

All work areas shall be clean and orderly at the completion of work and at times required by the Engineer during the progress of work.

Fiber Optic Cable Installation

Fiber optic cables shall be installed in continuous lengths without intermediate splices throughout the project, except at the location(s) specified in the Plans, or as approved in writing by the Engineer.

The Contractor shall comply with the cable manufacturer's specifications and recommended procedures including, but not limited to the following:

1. Installation.
2. Proper attachment to the cable strength elements for pulling during installation.
3. Bi-directional pulling.

4. Cable tensile limitations and the tension monitoring procedure.
5. Cable bending radius limitations.

The Contractor shall protect the loops from tangling or kinking. At no time during the length of the project shall the cable's minimum bending radius specification be violated.

To accommodate long, continuous installation lengths, bi-directional pulling of the fiber optic cable shall be permitted.

In all cable vaults, pull boxes, and at all splice locations cable slack of 50 feet shall be left by the Contractor, unless otherwise specified in the Plans. The 50 feet length of fiber optic cable shall be coiled and secured with tie raps to racking hardware, or as specified in the Plans.

Installation shall involve the placement of fiber optic cables in a specified inner duct, as defined in the Plans. The Contractor shall ensure that inner ducts are secured to prevent movement during the cable installation process.

The pulling eye/sheath termination hardware on the fiber optic cables shall not be pulled over any sheave blocks.

When power equipment is used to install fiber optic cabling, the pulling speed shall not exceed 100 feet per minute. The pulling tension limitation for fiber optic cables shall not be exceeded under any circumstances.

Large diameter wheels, pulling sheaves, and cable guides shall be used to maintain the appropriate bending radius. Tension monitoring shall be accomplished using commercial dynamometers or load-cell instruments.

Patch cords placed between pad mounted cabinets shall be protected by plastic spiral wrapping or flexible plastic duct. Spiral wrap or flexible plastic duct shall cover the entire length of the patch cord(s) to within 12 inches of end. The spiral wrap shall be installed before the patch cords are pulled into the conduit(s) and be rated for use in electrical installations.

Fiber optic cable lubricant shall be used to reduce pulling tensions for the installation of each fiber optic cable.

Fiber Optic Cable Splicing

Field splices shall be located as shown in the Plans. No additional splices will be allowed without the approval of the Engineer.

All fusion splicing equipment shall be in good working order, properly calibrated, and meeting all industry standards and safety regulations. Cable preparation, closure installation and splicing shall be accomplished in accordance with accepted and approved industry standards.

Upon completion of the splicing operation, all waste material shall be deposited in suitable containers for fiber optic disposal, removed from the job site, and disposed of in an environmentally acceptable manner.

1 The Contractor shall use the fusion method for fiber optic splicing. Acceptable fusion
2 splicing techniques are:
3
4 • Local Injections and Detection
5 • Profile Alignment System
6
7 The Contractor shall seal all cables where the cable jacket is removed. The cable shall
8 be sealed per the cable manufacturer's recommendation with an approved blocking
9 material.
10
11 The Contractor shall seal all buffer tubes with an approved blocking material to prevent
12 migration of gel into splice trays.
13
14 All splices shall be contained in splice trays utilizing strain relief, such as heat shrink
15 wraps, as recommended by the splice tray manufacturer.
16
17 Fiber Optic Splice Closure
18 All below ground splices shall be contained in waterproof splice closures. Splices shall
19 utilize two half shells bolted together with stainless steel bolts and be fitted with a
20 neoprene gasket. Selected splices shall not require a re-entry kit. Upon sealing the
21 splice closure, the Contractor shall show that the closure maintains 10 psi of pressure
22 for a 24-hour period.
23
24 Fiber Optic Cable Labeling
25 Permanent cable labels shall be used to identify fibers and patch cords at each
26 termination point. The cable labels shall consist of white colored heat shrink wraps with
27 identification based on the schematic shown on the ITS detail sheets.
28
29 Twisted-Pair Copper Cable Installation
30 The Contractor shall install all OSP cables and associated terminal blocks.
31
32 Cables shall be terminated in the communication hubs on a combination
33 connector/protector block, which shall be an AT&T Type 310 bifurcated quick clip
34 terminal block mounted on the wall of the vault. Protection shall be provided for each
35 pair. The surge protector shall be solid state, low voltage (60-90 volts) for non-ringing
36 circuits, 130 volts for ringing circuits and shall have a heat coil for sneak current
37 protection, and gold-plated pins. Protector block ground shall be connected to the
38 ground bus.
39
40 Where cables are terminated at terminal blocks in cabinets, the same pair assignment
41 shall be maintained.
42
43 Cable Racking in Pull Boxes and Cable Vaults
44 The Contractor shall rack the cable in vertical figure eight loops, which shall permit
45 pulling slack from the vaults without introducing twist to the cable.
46
47 Cables shall be secured in racked positions with nylon ties. Identification or warning
48 tags shall be securely attached to the cables in at least two locations in each pull box or
49 cable vault.
50

1 All coiled cable shall be protected to prevent damage to the cable and fibers. Racking
2 shall include securing cables to brackets (racking hardware) that extend from the side
3 walls of the pull box.

4
5 All racking hardware shall be stainless steel.

6
7 As-Built Records

8 The Contractor shall provide the Engineer with a cable route diagram for all installed
9 fiber optic and twisted pair cables. The diagram shall show the actual cable routes and
10 "meter marks" where each cable enters and exits pull boxes, cable vaults, junction
11 boxes, splices and termination points. The Contractor shall record these points during
12 cable installation. The diagram shall also include all ITS device locations as well as the
13 location and quantity of slack cable. The cable route diagram shall be submitted to the
14 Engineer as part of the Fiber Cable Testing documentation.

15
16 (February 19, 2009)

17 Section 8-20.1(1) is supplemented with the following:

18
19 **Electrical Inspection**

20 The Department of Labor and Industries' Electrical Inspector shall inspect and
21 approve the electrical portions of the project. Before work begins, the
22 Contractor shall contact the Department of Labor and Industries Electrical
23 Inspector at (425)290-1310 to coordinate a schedule of electrical inspection.
24 Work shall be done in accordance with WAC 296-46B-010. This project shall
25 conform to the current adopted version of the NEC. When electrical inspection
26 of work is required, the Contractor shall notify the Electrical Inspector at least
27 two days in advance. The Electrical Inspector's inspection and approval of all
28 electrical work is required before final acceptance of the project.

29
30 Since these signal(s) are being constructed on public right-of-way and will be
31 operated and maintained by Snohomish County, a Snohomish County Traffic
32 Signal Electrician will be required to inspect and approve electrical portions of
33 the project.

34
35 Final inspection and approval is required before the Contract can be completed.
36 The Contractor shall contact the County Signal Maintenance Supervisor at
37 (425)388-7551 a minimum of two (2) calendar days in advance of the agreed
38 upon points where electrical inspection is required, and give written notice to
39 the Engineer.

40
41 (October 8, 2013)

42 Section 8-20.2(1) is revised as follows:

43
44 Add the word "calendar" after "20" in the first paragraph.

45
46 Delete "If required to do so," in the first sentence of the second paragraph.

47
48 After the fourth paragraph add the following:

49
50 Shop drawing for signal standards and lighting standards shall be provided
51 in an electronic format, either AUTOCAD Release 14 or later, as well as
52 complying with Section 6-03.3(7).

The last paragraph which begins "Submittals required shall include..." is deleted.

(September 5, 2013)

Section 8-20.3(3) is supplemented with the following:

All existing equipment that is to be removed shall not be stockpiled within the job site without the Engineer's approval.

The following signal equipment shall remain the property of the Contracting Agency and shall be disconnected, dismantled, stacked separately, and delivered to the Contracting Agency:

- Traffic Signal Standards and Mast Arms
- Traffic Signal Controller Cabinets
- Electrical Service Cabinet
- Light Standards and Mast Arms
- Emergency Vehicle Detectors
- Vehicle and Pedestrian Displays and Mounting Hardware
- Pedestrian Pushbuttons
- Luminaires
- Video Cameras and Mounting Hardware
- Terminal Cabinets
- Visors
- Back Plates

Prior to the removal of any span wire from strain poles all associated vehicle and pedestrian signal heads, emergency vehicle detectors, video cameras, and signs shall be removed from each span.

Video cameras shall be given to the Engineer upon their removal.

The Contractor shall give the Engineer fourteen (14) calendar days advance written notice prior to delivery for removed materials to the Contracting Agency's storage facilities.

Controller cabinets shall not be removed until all associated electronic equipment is removed by Contracting Agency traffic signals personnel. All other equipment shall be removed by the Contractor, and delivered within 24 hours following removal to the Contracting Agency.

The salvaged material listed above shall be delivered to the following address between the hours of 8:30 a.m. and 2:30 p.m.

Snohomish County Public Works Cathcart Maintenance Center (PWCMC)
8915 Cathcart Way
Snohomish, WA 98296

Pole shaft and Mast Arm Identification

1 All removed mast arms and pole shaft shall be identified by paper identification
2 tags recording pole number, intersection location (such as SR XXX, jct XXX),
3 and mast arm length.
4

5 The tags shall be 4-inch by 6-inch (minimum) and be taped to corresponding
6 pole shafts and mast arms. Information on the mast arm tag shall match the
7 information on the corresponding pole shaft tag. Each tag shall be entirely
8 covered with clear acetate tape. The tape shall be wrapped on full circle
9 around the shaft or arm with a ½ inch minimum overlap at the ends and sides.
10

11 The Contractor shall bundle the complete signal standard assembly together.
12 The assembly consists of pole shaft, mast arm, and connecting bolts.
13 Connecting bolts shall be attached to the original mast arm base plate.
14

15 Dismantled equipment shall be clearly marked and all hardware saved in a
16 heavy duty burlap bag attached to the corresponding signal standard or mast
17 arm. The Contractor shall be responsible for loading, delivering, and unloading
18 the salvaged signal equipment, as directed by the Engineer.
19

20 The Engineer shall determine the condition of the signal equipment. Only
21 undamaged material parts will be accepted by the Contracting Agency.
22

23 If the Contractor's operation causes damage to removed equipment that is to
24 be returned, it shall be repaired or replaced by the Contractor to the Engineer's
25 satisfaction at no additional cost to the Contracting Agency.
26

27 The Contractor shall remove and dispose of properly all debris and signal
28 equipment not identified for return to the Contracting Agency.
29

30 **Equipment to Remain**

31 Care shall be taken to protect and preserve all existing equipment that is not
32 being removed under this Contract. Any existing equipment to remain that is
33 damaged by the Contractor will be repaired or replaced to the Engineer's
34 satisfaction, at no additional expense to the Contracting Agency.
35

36 The Contractor shall:
37

- 38 • Remove all wires for discontinued circuits from the conduit system.
- 39
- 40 • Remove elbow sections of abandoned conduit entering junction boxes.
- 41
- 42 • Remove abandoned conduit that is less than 18 inches below finished
- 43 grade, unless otherwise indicated in the Plans.
- 44
- 45 • Removal of foundations shall be performed in accordance with Section
- 46 2-02.3(1).
- 47
- 48 • Backfill voids created by removal of foundations and junction boxes.
- 49 Backfilling and compaction shall be performed in accordance with
- 50 Section 2-09.3(1)E.
- 51

(September 19, 2013)

Drilled Shafts For Traffic Signal Pole Foundations

This Special Provision covers the operations required to drill shafts for pole foundations, removal of all soil and rock materials encountered, disposal of all excavated materials, furnishing and placement of casing (if required), removal and disposal of any obstructions encountered, furnish and place steel reinforcement cages and concrete, and the work necessary to complete the drilled shaft construction, in accordance with these Special Provisions and as specified on the Plans.

Materials

Concrete

Concrete shall meet all requirements for Concrete Class 4000 as specified in Section 6-02, with the following exceptions:

1. The slump of the concrete shall be between 5 inches to 7 inches when tested in accordance with WSDOT Test Method No. 804 at the jobsite.
2. The Contractor may use a water-reducing admixture in accordance with Section 6-02.3(3), the manufacturer's written recommendations, and as directed by the Engineer in order to attain a slump of 5 inches to 7 inches.

Reinforcing Steel

All reinforcing steel shall meet the requirements of Section 9-07 and in accordance with the Plans.

Casing

1. The casing shall be of steel and of ample strength to withstand handling stresses and the external pressure of the caving soil and/or water.
2. The casing shall be watertight, smooth, and clean.
3. The inside diameter of the casing shall provide as a minimum the specified diameter of the shaft. No extra compensation will be allowed for concrete required to fill an oversized casing or an oversized excavation.

Construction Sequence

All excavation for the foundations in which the drilled shafts are to be constructed shall be completed before shaft construction begins. After shaft construction is completed, all loose or displaced materials shall be removed from around the shafts, leaving a clean solid surface to receive the footing concrete.

Shaft Excavation

1. Shafts shall be excavated to the required depth as shown in the Plans or as directed by the Engineer. The excavation shall be completed in a continuous operation using equipment capable of excavating through the type of material expected to be encountered. (Boring Log is available at the office of the Engineer.) The concrete shall be placed

1 immediately after the completion of shaft excavation and cleanout
2 without any undue delay.
3

- 4 2. If the shaft excavation is stopped with the approval of the Engineer, the
5 shaft shall be secured by the installation of a safety cover. It shall be the
6 Contractor's responsibility to ensure the safety of the shaft and the
7 surrounding soil and the stability of the sidewalls. A temporary casing
8 should be used if necessary to ensure such safety and stability.
9
- 10 3. Where caving conditions are encountered, due to soft soils or water
11 intrusion, no further excavation will be allowed until the Contractor
12 selects a method to prevent ground movement. The Contractor may
13 elect to place a temporary casing or use other methods approved by the
14 Engineer.
15
- 16 4. The Contractor shall use appropriate means such as a clean-out bucket,
17 to clean the bottom of the excavation such that a minimum of 50 percent
18 of the base of each shaft will have less than 1 inch of sediment at the
19 time of placement of the concrete. The maximum depth of sediment or
20 any debris at any place on the base of the shaft shall not exceed 2
21 inches.
22
- 23 5. When unexpected obstructions, which require specialized equipment
24 and/or labor are encountered, the Contractor shall notify the Engineer
25 promptly and the obstructions shall be removed and the excavation
26 continued as directed by the Engineer.
27

28 **Excavation Inspection**

- 29 1. The Contractor shall provide equipment for checking the dimensions
30 and alignment of each permanent shaft excavation. The dimensions
31 and alignment shall be determined by the Contractor under the direction
32 of the Engineer.
33
- 34 2. Final shaft depths shall be measured with a suitable weighted tape or
35 other approved methods after final clean-out.
36
- 37 3. Shaft cleanliness will be determined by the Engineer, by visual
38 inspection.
39
- 40 4. The excavated shaft shall be approved by the Engineer prior to placing
41 any steel or concrete into the shaft.
42

43 **Reinforcing Steel Cage Construction and Placement**

- 44 1. The reinforcing steel cage consisting of longitudinal bars, ties, cage
45 stiffener bars, spacers, centralizers, and other necessary appurtenance
46 shall be completely assembled and placed as a unit immediately after
47 the shaft excavation is inspected and accepted prior to concrete
48 placement. The reinforcing cage shall be rigidly braced to retain its
49 configuration during handling and when lowered into the shaft, during
50 placement of concrete and extraction of the casing from the shaft. No
51 loose bars will be permitted. The reinforcing steel fabricator shall

1 include bracing and any extra reinforcing steel required to fabricate the
2 cage in the shop drawings.

- 3
4 2. If the bottom of the constructed shaft elevation is lower than the bottom
5 of the shaft elevation in the Plans, a minimum of ½ of the longitudinal
6 bars required in the upper portion of the shaft shall be extended the
7 additional length. Tie bars shall be continued for the extra depth, spaced
8 on 2 feet centers, and the stiffener bars shall be extended to the final
9 depth. These bars may be lap spliced, or unspliced bars of the proper
10 length may be used. Welding to the planned reinforcing steel will not be
11 permitted unless specifically shown in either the Plans or Special
12 Provisions.
13
14 3. The reinforcing steel in the shaft shall be tied and supported so that the
15 reinforcing steel will remain within allowable tolerances given in this
16 Specification. Concrete spacers or other approved noncorrosive
17 spacing devices shall be used at sufficient intervals (near the bottom
18 and at intervals not exceeding 5 feet up the shaft) to insure concentric
19 spacing for the entire cage length. Spacers shall be constructed of
20 approved material equal in quality and durability to the concrete
21 specified for the shaft.
22
23 4. The elevation of the top of the steel cage shall be checked before and
24 after the concrete is placed. If the rebar cage is not maintained within
25 the specified tolerances, corrections shall be made by the Contractor as
26 directed by the Engineer. No additional shafts shall be constructed until
27 the Contractor has modified his rebar cage support in a manner
28 satisfactory to the Engineer.

29 **Concrete Placement**

30 Concrete placement shall commence within 2 hours after completion of the
31 excavation and shall be placed in one continuous operation to the top of the
32 shaft. Concrete shall be placed through a tremie. The tremie used shall
33 consist of a tube of one-piece construction. Concrete shall be placed
34 through a hopper at the top of the tube so that the concrete is deposited
35 through the center of the reinforcing steel to prevent segregation of the
36 aggregates and splashing of concrete on the reinforcement cage. The
37 Contractor's proposed method for depositing concrete shall have approval
38 of the Engineer prior to concrete placement. The concrete on the top 5 feet
39 of the shaft shall be vibrated.
40

41 **Casing Removal**

42 During casing removal, a minimum 5-foot head of concrete must be
43 maintained to balance the soil and water pressure at the bottom of the
44 casing. This casing shall be well coated with form oil prior to concrete
45 placement.
46

47 **Construction Tolerances**

- 48 1. The centerline of the drilled shaft shall be within 3 inches of Plan
49 position in the horizontal plane, at the Plan elevation for the top of the
50 shaft.
51
52

2. The vertical alignment of the shaft excavation shall not vary from the Plan alignment by more than 1/4 inch per foot of depth.
3. After all the concrete is placed, the top of the reinforcing steel cage shall be no more than 1/2 inch above and no more than 1/2 inch below the Plan position.
4. The minimum diameter of the drilled shaft shall be 1 inch less than the specified shaft diameter.
5. The top elevation of the shaft shall have a tolerance of $\pm 1/2$ inch from the Plan top of shaft elevation.
6. Excavation equipment and methods shall be designed so that the completed shaft excavation will have a flat bottom. The cutting edges of excavation equipment shall be normal to the vertical axis of the equipment within a tolerance of $\pm 3/8$ inch per 12 inches of diameter.

Drilled shaft excavations constructed in such a manner that the concrete shaft cannot be completed within the required tolerances are unacceptable. When approved, corrections may be made to an unacceptable drilled shaft excavation by any approved combination of the following methods:

1. Overdrill the shaft excavation to a larger diameter to permit accurate placement of the reinforcing steel cage with the required minimum concrete cover.
2. Increase the number and/or size of the steel reinforcement bars.

The approval of the correction procedures is dependent on analysis of the effect of the degree of misalignment and improper positioning. Correction methods may be approved as design analysis indicate. Redesign drawings and computations prepared by the Contractor's Engineer shall be signed by a Professional Engineer licensed in the State of Washington. Materials and work necessary, including engineering analysis and redesign, to effect corrections for out of tolerance drilled shaft excavations shall be furnished at no cost to the County.

Commercial concrete shall be allowed for the foundations for the Voyager Middle School DSS.

Submittals

1. Before placing the reinforcing steel, the Contractor shall submit shop drawings to the Engineer as specified in Section 1-05.3 for the reinforcing cage.
2. Work shall not proceed until the appropriate submittals have been approved in writing by the Engineer.

(September 6, 2012)

Section 8-20.3(5) is supplemented as follows:

1 All conduits shall be Schedule 80 PVC, unless otherwise specified in the Plans.

2
3 All PVC conduits shall contain #8 bonded ground wire.

4
5 After final assembly in place, as soon as the mandrel has been pulled through,
6 a flat profile, prelubricated, sequential footage marked woven polyester pull
7 tape with a minimum tensile strength of 1250 pounds shall be pulled through
8 each conduit scheduled for fiber optic communication.

9
10 Once a pull tape is used and pulled out in a conduit, another pull tape shall be
11 installed for future use.

12
13 (March 17, 2009)

14 Section 8-20.3(6) is supplemented as follows:

15
16 Wiring shall not be pulled into any conduit until all associated junction boxes
17 have been adjusted to or installed in their final grade and location, unless
18 installation is necessary to maintain system operation. If wire is installed for this
19 reason, sufficient slack shall be left to allow for final adjustment.

20
21 Junction box lids shall have grounding lugs and be mechanically and electrically
22 bonded.

23
24 Junction boxes are to be placed outside of the sidewalk, unless otherwise
25 directed by the Engineer.

26
27 If junction boxes are placed in the sidewalk, they shall not be placed closer than
28 12 inches from the edge of any sidewalk or sidewalk joint. The frame and lid
29 shall be from 0 to 3/16 inch below a straight edge laid across the sidewalk, and
30 the lid shall be flat to a maximum of 1/16 inch positive camber. Premolded joint
31 filler for expansion joints shall be placed around junction boxes installed in
32 sidewalks.

33
34 Maximum spacing between junction boxes, cable vaults, and pull boxes for fiber
35 optic communication shall not exceed 1,000 feet.

36
37 (April 5, 2013)

38 Section 8-20.3(8) is revised as follows:

39
40 The third paragraph is deleted and replaced with the following:

41
42 All splices in underground illumination circuits and inductive loop circuits shall
43 be installed in junction boxes. The only splice allowed in vehicle detection
44 circuits shall be the splice connecting the detector lead-in conductors to the
45 shielded home run cable. Splices for induction loop circuits shall be heat
46 shrink type with moisture blocking material, sized for conductors. All
47 connections with #10 and smaller wire shall use compression butt joint copper
48 crimped connectors installed with a positive-action (ratchet) tool, except for
49 quick disconnects as described in Section 9-29.7. The non-insulated die shall
50 be an indent type and the insulated die shall be of a smooth shape capable of
51 crimping pre-insulated terminals and connectors. The tool shall be a
52 compound-lever type with a ratchet mechanism to ensure positive closure for

1 the full crimping cycle. The tool shall be field adjustable to proper calibration
 2 with common tools and materials. Each individual conductor shall then have
 3 an approved waterproof heat-shrink tube installed, which completely covers
 4 the compression connector and extends a minimum of one-half inch beyond
 5 each end of the compression connector. All conductor connections shall be
 6 offset from adjacent connections by a minimum of one inch. A final approved
 7 waterproof heat shrink tube shall then be installed over the pair of splices in
 8 each circuit.

9
 10 Wire ends for pre-empt detection, vehicle detection, pedestrian detection
 11 (except for coax video detection cable) communication, and vehicle and
 12 pedestrian displays shall have suitably sized horseshoe spade connectors
 13 crimped onto stripped and cleaned wire ends using an approved crimp tool
 14 designed for the purpose.

15
 16 All splices shall be made in the presence of the Engineer.

17
 18 The second sentence of the seventh paragraph is revised to read as follows:

19
 20 Splice insulation shall be heat shrink.

21
 22 **(September 19, 2013)**
 23 **Field Wiring Chart**

24	501	AC+ Input	516-520 Railroad Pre-empt
25	502	AC- Input	5A1-5D5 Emergency Pre-empt
26	503-510	Control-Display	541-580 Coordination
27	511-515	Sign Lights	581-599 Spare

28	Movement Number	1	2	3	4	5	6	7	8	9
----	-----------------	---	---	---	---	---	---	---	---	---

29
 30
 31
 32 Vehicle Head

33	Red	611	621	631	641	651	661	671	681	6*1
34	Yellow	612	622	632	642	652	662	672	682	6*2
35	Green	613	623	633	643	653	663	673	683	6*3
36	Spare	614	624	634	644	654	664	674	684	6*4
37	Spare	615	625	635	645	655	665	675	685	6*5
38	AC-	616	626	636	646	656	666	676	686	6*6
39	Red Auxiliary	617	627	637	647	657	667	677	687	6*7
40	Yellow Auxiliary	618	628	638	648	658	668	678	688	6*8
41	Green Auxiliary	619	629	639	649	659	669	679	689	6*9

42
 43
 44 Pedestrian Heads & Dets.

45	Hand	711	721	731	741	751	761	771	781	7*1
46	Man	712	722	732	742	752	762	772	782	7*2
47	AC-	713	723	733	743	753	763	773	783	7*3
48	Detection	714	724	734	744	754	764	774	784	7*4
49	Common-Detection	715	725	735	745	755	765	775	785	7*5
50	Spare	716	726	736	746	756	766	776	786	7*6
51	Spare	717	727	737	747	757	767	777	787	7*7

1	Spare	718	728	738	748	758	768	778	788	7*8
2	Spare	719	729	739	749	759	769	779	789	7*9

3
4 * Overlap Phase Designator 9,A, B, - - - - -.

5
6 (September 5, 2013)
7 Section 8-20.3(10), Services transformer, and Intelligent Transportation System
8 (ITS) Cabinet, is supplemented with the following:
9

10 The Contractor shall obtain 120/240 volt, 60 HZ, AC electrical services
11 approved by Snohomish County PUD No. 1 as shown in the Plans for traffic
12 signal display and detection system(s) at the intersection(s) of ***\$1\$***.

13
14 The service addresses:

15
16 ***\$2\$***

17
18 ***\$3\$***

19
20 The Contractor shall provide the conduit and conductors in accordance with the
21 NEC from the electrical pedestal, as shown on the Plans, to inside the service
22 panel with sufficient conductor length to make the necessary connections
23 conforming to the details shown.

24
25 Wires used as extensions of existing circuits shall have the same NEC rating as
26 the existing wires.

27
28 Conductors used for power or illumination shall meet the following
29 requirements:

- 30
31 1. Use single conductors, Class B stranded, annealed copper per ASTM
32 B3, IPCBA-NEMA S-19-81, as currently amended.
33
34 2. Cross-linked polyethylene insulation jacket per U.L. Standard 854 for
35 type USE and U.I. Standard 44 for type RHH-RHW.
36
37 3. Ampacity rating shall conform to current NEC requirements.

38
39 **Service Connection Fees**

40 The Contractor shall be responsible for making the necessary arrangements
41 and payment of connection fees to the serving utility (Snohomish County Public
42 Utility District No. 1, Customer Engineer, 2320 California Ave, Everett, WA) to
43 complete the service connection(s), and shall coordinate with the serving utility
44 on exact locations. The serving utility will make the final connection between
45 the electrical service and the power source by extending the conduit and using
46 the conductors provided under this Contract as shown on the Plans.

47
48 An "Application For Utility Service" for each intersection will be mailed by the
49 Contractor to the Snohomish County PUD No. 1 as the first order of work.

50
51 **Telephone/DSL Service**

1 The Contractor shall provide and install the conduit and conductors as shown
2 on the Plans, and including all necessary conduit fittings, risers, standoffs,
3 weatherheads and other materials to reach the telephone connection location
4 as shown on the Plans or designated by the Engineer. Prior to pouring
5 foundations and installing conduit the Contractor shall verify the connection
6 locations with the utility.
7

8 The Contractor shall contact Snohomish County Traffic Management
9 Coordinator Jason Letran at 425-388-3488 extension 4370, when the
10 Contractor is ready for the telephone service to be activated. The Contracting
11 Agency will arrange for the utility to activate the telephone service. The utility
12 will provide the necessary equipment and make the final connections at the
13 connection location.
14

15 **(February 19, 2009)**

16 **Service**

17 Section 8-20.3(10), Services transformer, Intelligent Transportation System Cabinet, is
18 supplemented with the following:
19

20 The Contractor shall obtain 120/240 volt, 60 HZ, AC electrical services approved by
21 Snohomish County PUD No. 1 as shown in the Plans for traffic signal display and
22 detection system(s) at the intersection(s) of ***\$1\$\$.
23

24 The service addresses:

25 ***\$2\$*

26 ***\$3\$*

27
28
29 The Contractor shall provide the conduit and conductors in accordance with the
30 NEC from the electrical pedestal, as shown on the Plans, to inside the service
31 panel with sufficient conductor length to make the necessary connections
32 conforming to the details shown.
33

34
35 Wires used as extensions of existing circuits shall have the same NEC rating as the
36 existing wires.
37

38 Conductors used for power or illumination shall meet the following requirements:
39

- 40 1. Use single conductors, Class B stranded, annealed copper per ASTM B3,
41 IPCBA-NEMA S-19-81, as currently amended.
42
43 2. Cross-linked polyethylene insulation jacket per U.L. Standard 854 for type USE
44 and U.I. Standard 44 for type RHH-RHW.
45
46 3. Ampacity rating shall conform to current NEC requirements.
47

48 **Service Connection Fees**

49 The Contractor shall make the necessary arrangements with the serving utility
50 (Snohomish County Public Utility District No. 1, Customer Engineer, 2320 California
51 Ave, Everett, WA) to complete the service connection(s), and shall coordinate with
52 the serving utility on exact locations. The serving utility will make the final

1 connection between the electrical service and the power source by extending the
2 conduit and using the conductors provided under this Contract as shown on the
3 Plans.
4

5 A copy of the "Application For Utility Service" and a copy of the pay voucher for
6 each intersection will be provided to the Contractor.
7

8 **Telephone/DSL Service**

9 The Contractor shall provide and install the conduit and conductors as shown on
10 the Plans, and including all necessary conduit fittings, risers, standoffs,
11 weatherheads and other materials to reach the telephone connection location as
12 shown on the Plans or designated by the Engineer. Prior to pouring foundations
13 and installing conduit the Contractor shall verify the connection locations with the
14 utility.
15

16 The Contractor shall contact Snohomish County Traffic Management Coordinator
17 Maxine Ponds at 425-388-3117, when the Contractor is ready for the telephone
18 service to be activated. The Contracting Agency will arrange for the utility to
19 activate the telephone service. The utility will provide the necessary equipment and
20 make the final connections at the connection location.
21

22 (September 5, 2013)

23 Section 8-20.3(11), second sentence of the fourth paragraph, which begins "The
24 Contractor shall provide the Engineer a minimum of 5 day's ..." is deleted and
25 replaced with the following:
26

27 A Pre-Turn On Coordination Meeting attended by the Engineer and the
28 Contractor is required a minimum of fourteen (14) calendar days prior to turn
29 on. The turn on schedule and date shall be arranged and confirmed at the
30 meeting. All functional tests and other tests required by the Contract
31 Specifications shall be completed to the satisfaction of the Engineer 48 hours
32 prior to the turn on date.
33

34 Section 8-20.3(11), fourth paragraph, replace all references to "Contracting Agency
35 electronics technician" with "Operating Agency signal technician".
36

37 The following is added to the end of Section 8-20.3(11):
38

39 On the same day, and following successful turn on, the Contractor shall adjust
40 all optically-programmed signal heads and all louvered signal heads, as
41 directed by the Engineer. Additionally, the Contractor shall remove all
42 conflicting signs and signal equipment not specified to remain, as directed by
43 the Engineer.
44

45 (May 27, 2010)

46 Section 8-20.3(14)B, the first paragraph is supplemented with the following:
47

48 Signal head shall be covered before the signal turn-on. If there are yellow
49 tapes on the back plates, the whole assembly shall be covered completely.
50

51 (April 17, 2009)

52 Section 8-20.3(14)C is supplemented with the following:

Item 4 is supplemented as follows:

The loop locations shall be marked on the pavement by the Contractor and approved by the Engineer prior to sawcutting. At no point shall any of the sawcuts pass closer than 12 inches to any utility cover.

Item 6 is supplemented as follows:

Loop installation shall not take place in temperatures below 40°F.

Item 7 is supplemented as follows:

The sawcuts shall be of uniform depth and any sharp edges, abrasions, or ridges shall be removed prior to placing the wire.

Sawcut Cleaning

The high pressure washer shall operate at 1000 psi minimum pressure as certified by the manufacturer's label on the machine or as measured by an in line pressure gauge.

All requirements of Section 1-07.15, "Temporary Water Pollution/Erosion Control" shall be observed as specified in the Contract and in the Plans when the sawcut cleaning is performed.

Item 11 is supplemented as follows:

Loop detector sealant shall conform to one of the following specifications, chosen based on Case A or Case B application:

Case A

Induction Loop Detectors installed and sealed into the finish lift of asphalt shall conform to these criteria:

TEST PARAMETER	SPECIFICATION LIMITS
Safe Heating Temperature	410°F
Pour Temperature	380°F
Penetration, 77°F, 6 oz, 5 sec.	10-25 dmm
Penetration, 126°F, 2 oz, 5 sec.	50 dmm max.
Softening Point °F	410°F min
Ductility, 125°F, in.	6°F min.
Mandrel Bend, 0°F, 90 degrees, 10 sec., 1/2 " diameter	Pass 2 of 3

Case B

Induction Loop Detectors installed and sealed into the pavement surface prior to finish lift of asphalt (or into a paving course which is to be resurfaced within one year) shall conform to this criteria:

TEST PARAMETER	SPECIFICATION LIMITS
Safe Heating Temperature	421°F

Pour Temperature	390°F max.
Penetration, 77°F, 6 oz, 5 sec.	65 dmm
Flow at 140°F (D3407)	0
Softening Point °F	210°F min.
Resilience (D3407)	50%
Penetration at 140°F	130%

Case B shall be used unless otherwise specified on the Plans.

The loop sealant shall be applied in accordance with the manufacturer's recommendations.

Except as noted in the following pre-approved list of this Section, samples of each item shall be submitted to the Engineer for approval.

Pre-approved list:

- Crafc0 Loop Detector Sealant #34271
- 3M Detector Loop Sealant 5000
- DEERY Loop Sealant LW

Item 12 is supplemented as follows:

If the area around the conduit stub-out is greater than 2 inches in width, hot mix asphalt concrete shall be installed.

(April 5, 2013)

Section 8-20.3(14)E is supplemented with the following:

Signal standards shall be round tapered, not polygonal tapered.

Temporary Signal and Illumination System

(July 5, 2012)

Section 8-20 is supplemented with the following:

Description

This work shall consist of supplying, installing, maintaining, and removing temporary signal system(s) at the intersections of *****\$1\$*****, and adjusting signal equipment as detailed in the Plans and these Special Provisions.

Materials

Materials shall conform to the applicable portions of Section 8-20.2 of the Standard Specifications and Special Provisions, except as modified herein.

Contracting Agency Supplied Items:

The Contracting Agency will supply the following items each temporary signal and illumination system.

Model 336 Controller Cabinet (pole-mounted & fully wired)	*** \$1\$ ***
Type 170E Signal Controller	*** \$2\$ ***
Model 210E Conflict Monitor	*** \$3\$ ***
Model 400 or 2400 Modem	*** \$4\$ ***

Model 200 Load switches	***\$5\$***
Video Detection Board: TRAFICON VIP 3.1D or 3.2D	***\$6\$***
Rainbow Camera and Lens complete in Housing	***\$7\$***
Model 222 Vehicle Detector Amplifiers	***\$8\$***
Model 242 or Model 244 Pedestrian Detector Isolators	***\$9\$***
Model 752 Pre-Emption Discriminators	***\$10\$***
Model 721 Pre-Emption Detectors	***\$11\$***
Model 204 Flashers	***\$12\$***
Controller Cabinet Print	***\$13\$***
Pole Mounting Hardware Kit	***\$14\$***

Contracting Agency supplied materials shall be scheduled for pickup through the Traffic Operations Supervisor during normal working hours between 7:00 a.m. and 2:30 p.m., at the following address:

Snohomish County Public Works Cathcart Maintenance Center (PWCMC)
8915 Cathcart Way
Snohomish, WA 98296

The Contractor shall give five (5) calendar days advance notice to the Engineer and Traffic Operations Supervisor to request release of the supplied materials. The Contractor may request release of the agency supplied materials only after any required electrical service has been installed, inspected, and approved.

After successful turn-on of each permanent traffic signal display and detection system, the Contractor shall place the Contracting Agency supplied items on a pallet and contact the Snohomish County Public Works Maintenance Facility within five (5) calendar days to arrange for delivery.

Equipment List and Drawings

If there is no temporary signal system design in the Plans, the Contractor shall submit to the Engineer within twenty (20) calendar days following execution of the Contract the design drawings and computations for each temporary signal system. The design drawings and computations shall be prepared, stamped, and signed by the Contractor's Engineer. The Contractor's Engineer shall be a Professional Engineer licensed in the State of Washington. The Contractor's Engineer shall use the field soils logs or geotechnical engineering report for foundation design. The design shall be in accordance with Standard Plan J-15.15-00. The Contractor's submittal and the Engineer's review of the temporary signal and illumination system design shall be in accordance with the Special Provision, "Illumination, Traffic Signal Systems, and Electrical", subsection, "Equipment List and Drawings". The temporary signal system(s) shall provide phasing for both vehicle and pedestrian movements at the intersection. The Contractor's temporary signal design will be subject to approval or disapproval by the Engineer and shall include:

- Vehicle and Pedestrian Detection
- Wiring for Signal Phasing
- Pole Locations
- Pole and Guy Computations
- Signal Display
- Controller Location

- Power Service Location
- Emergency Pre-empt
- Illumination
- Communication

The Contractor's proposed temporary signal system design shall be compatible with the Contracting Agency's existing traffic operation system.

Construction Requirements

The temporary signal and illumination systems shall be provided, tested, and installed per the Standard Specifications, applicable Standard Plans, and applicable Special Provisions, and shall conform to the applicable codes, and requirements of Section 8-20 and Section 9-29.

No new equipment for permanent signal system shall be used for temporary signal systems.

The Contractor shall supply temporary illumination and communication where existing illumination and communication are removed. The temporary illumination shall comply with Section 9-29.10.

All work shall be coordinated in a manner that does not disrupt the public safety and traffic flow through the project. Existing systems shall be in operation at all times until the temporary systems have been tested and approved for normal operation. Approved temporary systems, as detailed herein, shall be in operation at all times between the shut down of the existing systems and turn-on of the permanent systems. The Contractor shall adjust signal head locations as directed by the Engineer to accommodate changes in lane configuration and traffic flow during construction as part of this item of work.

The turn on of the temporary signal and illumination system shall comply with Section 8-20.3(11) of these Special Provisions.

Measurement

Section 8-20.4 is supplemented with the following:

The temporary signal and illumination system shall be measured per lump sum for each signal and illumination system installed, tested, operated, and removed complete per the Plans, and as specified herein.

Payment

Section 8-20.5 is supplemented with the following:

"Temporary Signal and Illumination System", per lump sum.

The unit contract price per lump sum for "Temporary Signal and Illumination System" shall be full compensation for all labor, tools, materials, and equipment required to submit, provide, install, operate, reposition, maintain, and remove each system as specified.

All costs for the associated electrical inspections shall also be included in the lump sum contract price for each "Temporary Signal and Illumination System".

1 **Division 9**

2 **Materials**

3
4 **ILLUMINATION, SIGNAL, ELECTRICAL**

5
6 **Conduit, Innerduct, and Outerduct**

7
8 **Rigid Metal Conduit Fittings and Appurtenances**

9 (November 10, 2011)

10 Section 9-29.1(2) is revised as follows:

11
12 Delete "electroplated" from the first sentence.

13
14 Paragraph one is supplemented with the following:

15
16 Galvanizing repair paint requirements for conduit couplings shall also apply to end
17 bushings.

18
19 Add the following after the fifth paragraph:

20
21 **Conduit Coatings**

22 GRS Conduit fittings shall be coated with galvanizing repair paint in the same
23 manner as conduit couplings. Electroplated fittings are not allowed.

24
25 Conduit entering concrete shall be wrapped in 2-inch wide pipe wrap tape with a
26 minimum 1 inch overlap for 12 inches on each side of the concrete face. The tape
27 shall have a synthetic rubber adhesive with a fungus inhibitor.

28
29 **Surface Mounting Conduit Attachment Components**

30 Conduit clamp shall be hot-dip, galvanized steel or stainless steel, and shall be one
31 piece, two bolt units with locking nuts. The clamps shall be attached to the unistrut
32 on both sides of the conduit with bolts and associated hardware. The minimum
33 distance between adjacent clamps and between the clamp and the end of the
34 unistrut shall be 1 inch.

35
36 **Conduit Expansion and/or Deflection Fitting**

37 Expansion fittings, deflection fittings, and expansion/deflection fittings embedded in
38 concrete shall be PVC coated.

39
40 ***Innerduct***

41 (June 3, 2010)

42 Section 9-29.1(5) is deleted in its entirety and replaced with the following:

43
44 Innerduct shall be a fabric, multi-celled, textile product. Innerduct shall be installed in
45 continuous lengths without intermediate splices throughout the project, except at the
46 location(s) specified in the Plans, or as approved in writing by the Engineer.

47
48 The Contractor shall comply with the innerduct manufacturer's specifications and
49 recommended procedures to install and terminate the innerduct system.

50
51 Except as noted in the following pre-approved list of this section, samples of
52 innerduct shall be submitted to the Engineer for approval.

Pre-approved list:

- MaxCell MXC series Innerduct

Junction Boxes, Cable Vaults, and Pull Boxes

Standard Duty and Heavy-Duty Junction Boxes

(September 19, 2013)

Section 9-29.2(1) is supplemented with the following:

All junction box lids and frames shall be galvanized. Grounding lugs shall be stainless steel and shall be mechanically and electrically bonded.

Fiber Optic Cable, Electrical Conductors, and Cable

Fiber Optic and Copper Cable

(August 3, 2009)

Section 9-29.3(1) is supplemented with the following:

Communication Cables and Interfaces

(September 5, 2013)

Section 9-29.3 is supplemented with the following:

Quality Assurance

All materials described in this section shall meet or exceed the applicable provisions of the following documents:

1. CFR Title 7, Section 1755.900, RUS Specification for Filled Fiber Optic Cables
2. ANSI, C8.47-1983, American National Standard for Polyolefin-insulated Thermoplastic Jacketed Communication Cables
3. TIA/EIA-455-28-C, Method for Measuring Tensile Failure Point of Optical Waveguide Fibers
4. TIA/EIA-455-34-A, Interconnection Device Insertion Loss Test
5. TIA/EIA-455-95-A, Absolute Optical Power Test for Optical Fibers and Cables
6. EIA-598-B, Color Standard for Optical Fibers

Section 9-29.3(1) is supplemented with the following:

The Contractor shall provide manufacturer's certification that the submitted cable shall comply with the Rural Utilities Service (RUS) Specification 1755.900 as currently amended and with the requirements set forth in this Special Provision. Any deviations from these specifications shall be conspicuously noted in the Contractor's submittal.

Each cable shall contain the total number of optical fibers, as specified in the Plans. For all cables with a strand count greater than 36, the fibers shall be placed in loose buffer tubes in groups of 12. For all other cables, the fibers shall be placed in loose buffer tubes in groups of 6.

The fiber optic cable outer jacket shall be marked with the manufacturer's name, the year of manufacture, the words OPTICAL CABLE, and sequential meter marks. The markings shall be repeated every one meter. The actual length of the cable shall be

1 within +/- 0.1% of the length marking. The marking shall be in contrasting color to the
2 jacket. The marking shall be 2.5mm in height and shall be permanent and weatherproof.

3
4 Cable shall be of loose tube design. The tubes shall be surrounded by dry moisture
5 blocking filling compound or tape. The tubes may be filled with dry moisture blocking
6 powder surrounding the fibers.

7
8 The cable shall be constructed with the following components:

- 9
10 1. A dielectric central strength member
11 2. Buffer tubes containing optical fibers
12 3. Aramid (Kevlar) yarn
13 4. Outer MDPE jacket
14

15 The Contractor shall provide all materials required for the installation and splicing of the
16 specified communications cables, power cables, and associated interface devices.

17
18 The Contractor shall provide an unconditional warranty on all installed cable for a period
19 of one (1) year.

20
21 At the request of the Engineer, the Contractor shall submit a 3-foot sample cable section
22 to the Engineer for approval for each type of cable to be provided.

23 24 **Fiber Optic Cable Testing**

25 The installed optical fiber cable shall be tested for compliance with the transmission
26 requirements of this specification, the cable and hardware manufacturer's specifications,
27 and prescribed industry standards and practices.

28
29 Prior to commencing acceptance testing, the Contractor shall complete the installation of
30 the fiber optic system. This includes sealing the splice closures, completing the splicing
31 and dressing in the distribution panels, and racking the cables in the pull boxes and
32 cable vaults.

33
34 All testing values shall be in metric.

35 36 **Types of Testing**

37 The types of acceptance testing for optical fiber cable system certification are:

38
39 Power Meter testing

40
41 Optical Time Domain Reflectometer (OTDR) testing
42

43 **Power Meter Testing**

44 Power meter testing shall be used to measure the end-to-end attenuation of each
45 new fiber installed between a field device and a communications hub as well as
46 between communications hubs. Power meter testing shall be performed at the 1310
47 and 1550 nanometer wavelength in both directions.

48
49 Prior to commencing testing, the Contractor shall submit the manufacturer and model
50 number of the test equipment along with certification that the power meter has been
51 calibrated within 12 months of the proposed test dates.
52

The following information shall be documented for each fiber test measurement:

1. Fiber/Strand #
2. Fiber type (Singlemode or Multimode)
3. Cable, tube, and fiber IDs
4. Near end and far end test locations
 - Use device names in Contract plans
5. End-to-end attenuation
 - In each direction and the bidirectional average
6. Length of span being tested
7. Date, time, and operator
8. Wavelength

Optical Time Domain Reflectometer (OTDR) Testing

An optical time domain reflectometer (OTDR) with recording capability shall be utilized to test the end-to-end transmission quality of each optical fiber. Quality tests shall consider attenuation, reflectance, and discontinuities. The OTDR shall be equipped with 1310 nanometer and 1550 nanometer light sources for singlemode optical fibers. The OTDR shall be capable of providing electronic and hard copy records of each test measurement.

The Contractor shall utilize a dead-zone box (a.k.a. launch reel) containing 1 km of optical fiber, when performing OTDR tests. The dead-zone box shall be located between the OTDR and the fiber optic connector of each strand tested.

Each new fiber shall be tested in both directions at the 1310 and 1550 nanometer wavelengths. Existing fibers that are spliced to or re-spliced as part of this Contract shall also be tested in both directions and at both wavelengths.

The following information shall be documented for each fiber test measurement:

1. Fiber/Strand #
2. Fiber type (Singlemode or Multimode)
3. Cable and fiber IDs
4. X-Y plot scaled for fiber length
 - The X-axis (Distance) shall be scaled such that the beginning of the trace starts with the OTDR/dead-zone interface. The end of the trace shall extend no more than 1 km beyond the end of the test span.
 - The Y-axis (dB) shall be set to maximize the trace. The bottom of the Y scale shall begin above the noise floor and the top of the scale shall be no more than 5 dB higher than the largest event. No events or reflections shall be cut off.
5. Near end and far end test locations
 - Use device names in Contract plans
6. Date, time, and operator
7. Wavelength
8. OTDR Settings
 - Index of Refraction
 - Averaging time (Minimum of 30 seconds)
 - Pulse Width (to provide a smooth trace, excluding events)
9. Table of Events that includes: Event ID, Type, Location, Loss, and Reflection.
 - Events are defined as:

1. Any reflectance event in excess of -60 dB
2. Any loss occurrence in excess of 0.05 dB
3. Any splice location regardless of loss
4. Beginning and end of span
 - The beginning of the span shall be denoted by the "A-Marker". This marker shall be placed just to the left of the spike of the dead-zone box/fiber interface.
 - The end of the span shall be denoted by the "B-Marker". This marker shall be placed just to the left of the end-of span reflection spike.

Fiber Optic Performance Requirements

1. Splice Loss:
 - Shall not exceed 0.20 dB in one direction
 - Bidirectional Average shall not exceed 0.15 dB
2. Reflectance:
 - Shall not exceed -55 dB

Fiber Cable Testing Documentation

The Contractor shall submit one hard copy and one electronic copy of the fiber test results to the Engineer for approval. Only one OTDR test result shall be on each page. The Contractor shall take corrective actions on portions of the fiber installation determined to be out of compliance with these specifications.

Upon acceptance of the cable installation and test results, the Contractor shall submit three hard copies and three electronic copies of the fiber test results to the Engineer.

Hard copy submittals shall be bound in 3-ring binders. The electronic submittals shall be on compact discs and include one licensed copy of the applicable OTDR reader program.

The following information shall be included in each test result submittal:

1. Contract number, contract name, contractor name, and address
2. Dates of cable manufacture, installation, and testing
3. Cable specifications
 - Manufacturer data sheet
 - Helix Factor
 - Date of manufacture
4. Fiber (Glass) specifications
 - Manufacturer and Part #
 - Index of Refraction
 - Optical performance (loss/km)
 - Mode Field Diameter
5. As-Built Records (In accordance with the Special Provisions)
6. OTDR test results – No more than one test per page
7. Power Meter test results

Within 30 days of submitting the test results, the Contractor, in the presence of the Engineer, shall re-test a minimum of 5% of the previously tested locations to validate

1 the test results. A 5% sample will be selected randomly from the terminal device
2 locations.

3
4 Section 9-29.3(1)A is supplemented with the following:

5
6 Optical fiber shall meet the requirements of ITU G652 and specifically meet ITU G652.D
7 attributes. The fibers shall support the transmission of wavelengths for Coarse
8 Wavelength Division Multiplexing (CWDM), as defined in ITU G694.2.

9
10

11 **Electrical Conductors and Cable**

12 (June 29, 2010)

13 Section 9-29.3(2) is supplemented with the following:

14

15 Dual-Element six-conductor shall be a composite of two elements. The first element
16 shall have five 18 AWG stranded copper conductors and each shall have polyethylene
17 insulation, color coded White, Red, Blue, Black, and Brown. Insulation thickness shall be
18 a minimum of 16 mils. The second element shall have one 20 AWG solid copper
19 conductor and shall have foam polyethylene insulation with a minimum thickness of 56
20 mils. This shall be surrounded by a 95% bare copper braid with an outer polyethylene
21 insulation jacket with a minimum thickness of 35 mils.

22

23 Both elements shall be enclosed in an outer black PVC jacket having a minimum
24 thickness of 30 mils with ratings of 600V and 165°F. Both ratings shall be permanently
25 ink imprinted on the outer jacket. The total diameter of the entire assembly shall be 0.50"
26 ± 0.025 ".

27

28 Except as noted in the following pre-approved list of this section, samples of each item
29 shall be submitted to the Engineer for approval.

30

31 Pre-approved list:

32 Isotec part X341667-00

33

34 Section 9-29.3(2)H is deleted in its entirety and replaced with the following:

35

36 Three conductor shielded cable (3CS) for the detector circuit for optical fire preemption
37 receivers shall be Model 138 Opticom cable.

38

39 **Twisted-Pair (TWP) Copper Cable Testing**

40 The Contractor shall perform a Field Acceptance Test on the installed cable. Each pair
41 shall be tested for frequency attenuation between the communication hub and each ITS
42 device. The Contracting Agency will provide a witness during the tests and the test
43 results shall be documented as prescribed elsewhere in this specification.

44

45 Any pairs showing attenuation greater than 2 dB per mile at 1 kHz shall be cause for
46 rejection of the cable. The Contractor shall replace any cable failing this test at no
47 additional expense to the Contracting Agency. The Contractor shall provide all test
48 equipment necessary to perform the tests.

49

50 All pairs of each underground cable shall be tested for continuity, polarity, shorts,
51 grounds, longitudinal balance, and both resistive and impedance losses consistent with

the manufacturer's specifications and standard telecommunication industry requirements.

Each TWP copper cable intended primarily for data communication applications shall be tested end-to-end from the controlled environment vault cable termination point to the interface at the traffic control device. The transmission test procedure shall include the continuity testing of each pair within each TWP cable from the outlet in the termination panel in the vault to the termination outlet at each device location.

The Contractor shall ensure that all individual wires in all TWP cables have been terminated consistent with the wire insulation color to termination pin requirements set forth in this Special Provision.

The Contractor shall document the transmission quality test results for 50% of the pairs in each cable of the installed TWP cable and provide documentation for each cable that the cable meets or exceeds the manufacturer's published specifications and otherwise complies with the requirements set forth in this specification for characteristic impedance, longitudinal balance, resistive and impedance losses, and near-end crosstalk.

The Contractor shall provide the Engineer with the manufacturer and model number of the test equipment and the equipment calibration procedures to be used prior to conducting all tests.

The Contractor shall test each underground cable end-to-end from the controlled-environment vault-termination block to the terminal block at each cable pedestal or other outside plant terminal equipment. The Contractor shall provide actual test readings for each of the following items to verify the required transmission criteria:

DC Resistance - The resistance of any conductor in any cable shall not exceed 20 ohms per 1000 feet.

DC Resistance Unbalance - The resistance unbalance between the two conductors of any pair shall not exceed 5%.

Ambient Noise Measurements - The Contractor shall measure the ambient noise level in dBm0 to determine the level of noise on each cable being tested. The distant end of the pair being tested should be terminated with a 600-ohm resistor. At the near end, an HP-3551 or equivalent transmission measuring set should be configured for conducting a noise reading test. Cable pairs being sampled shall provide an ambient noise figure of 30 Dbm0 (-60 dBm) or better. The Contractor shall record all readings.

Shield Continuity - Test and measurements shall be made to assure that all underground cable shields are continuous from end-to-end. Each shield shall show a resistance of not more than .75 ohms per 1000 feet.

Within 30 days of submitting the test results, the Contractor, in the presence of the Engineer, shall re-test a minimum of 5% of the previously tested locations to validate the test results. A 5% sample will be selected randomly from the terminal device locations.

Electrical Splice Materials

1 **Traffic Signal Splice Material**

2 (January 10, 2012)

3 Section 9-29.12(2) is deleted in its entirety and replaced with the following:

4
5 Induction loop splices shall be moisture blocking two-way (in line) heat shrink, meeting
6 Mil Spec I-23053.

7
8 **Control Cabinet Assemblies**

9
10 ***Traffic Signal Controller Assembly Testing***

11 (September 5, 2013)

12 Section 9-29.13(2)A is supplemented with the following:

13
14 All signal control equipment furnished under this contract shall be tested at
15 Snohomish County Public Works Cathcart Maintenance Center (PWCMC), 8915
16 Cathcart Way, Snohomish, WA 98296. Snohomish County reserves the right to
17 utilize other testing facilities such as (1) Washington State DOT Materials Laboratory
18 at Tumwater, WA; (2) Oregon State Department of Transportation Materials
19 Laboratory in Salem, Oregon; or, (3) SML in California. The tests shall check the
20 operation of each individual component as well as the overall operation of the
21 system. The Contractor will include the shipping costs of all equipment to the
22 testing facility and any cost for return of failed equipment not meeting Snohomish
23 County Standards.

24
25 The Contractor shall give fourteen (14) calendar days written notice to the Engineer
26 prior to delivering the signal control equipment to the Snohomish County Signal
27 Maintenance Facility. The equipment shall be delivered far enough in advance of
28 actual need to allow for testing by the Contracting Agency or other agencies. This
29 may involve retesting because of failures or rejections. The County may require
30 thirty-five (35) calendar days for testing the signal control equipment. This time will
31 increase if the equipment does not meet the contract requirements or is incomplete.

32
33 If more than thirty-five (35) calendar days are required for any individual testing or
34 retesting by the Contracting Agency, an extension of time will be considered in
35 accordance with Section 1-08.8.

36
37 Tests in environment chamber will only be run as needed for type changes.

38
39 Upon successful completion of testing by Snohomish County Public Works, the
40 signal controller equipment shall be available for pickup at the Snohomish County
41 Public Works Cathcart Maintenance Center (PWCMC) located at 8915 Cathcart
42 Way, Snohomish, WA 98296. A certificate verifying environmental testing, if
43 required, shall be supplied in the cabinet to Snohomish County for each respective
44 control cabinet.

45
46 The Contractor shall notify the Contracting Agency in writing a minimum of fourteen
47 (14) calendar days before the Contractor is ready to pick up the signal controller
48 cabinet. The Contractor shall not pick up the controller cabinet from the Contracting
49 Agency until the electrical service is energized and all site preparation required to
50 install the controller cabinet is complete.

51
52 **Documentation**

1 A complete documentation set shall be furnished with the control equipment prior to
2 the start of testing. It shall include the following:

- 3
- 4 1. Serial numbers when applicable.
- 5
- 6 2. Written certification that equipment of the same make and model has been
7 tested according to NEMA Environmental Standards and Test Procedures,
8 and has met or exceeded these standards. The certificate shall include
9 equipment model number and where, when, and by whom the tests were
10 conducted. This certificate shall accompany each shipment of controllers.
- 11
- 12 3. The Contractor shall provide wiring diagrams, including a duplicate set on
13 standard CD or DVD containing the diagrams for all controllers in AUTOCAD
14 Release 2006 or later and two blue-tone prints for each controller and
15 cabinet supplied. The sheet size shall be 22 inches by 34 inches
- 16
- 17 4. Wiring diagrams for all auxiliary equipment furnished. One set per cabinet.
- 18
- 19 5. Complete operations and maintenance manuals including complete and
20 correct software listing and flow charts, five sets of operations and
21 maintenance manuals per cabinet, and five sets of software listings and flow
22 charts.
- 23
- 24 6. Complete operations and maintenance manuals for all auxiliary equipment.
25 One set per cabinet.
- 26

27 The operational and maintenance manuals for each traffic signal controller
28 supplied including as a minimum, but not to be limited to the following:

- 29
- 30 a. Detailed instructions for maintaining all hardware components,
31 controller, and auxiliary equipment.
- 32
- 33 b. A complete parts list detailing all manufacturer's identification codes.
- 34
- 35 c. Detailed wiring diagrams and schematics indicating voltage levels
36 and pictorial description, part name, and location for all hardware
37 components, controller, and auxiliary equipment.
- 38

39 All failed or rejected equipment shall be removed from the Snohomish County Public
40 Works Cathcart Maintenance Center within seven (7) calendar days following
41 notification; otherwise, the failed or rejected equipment will be returned, freight
42 collect, to the Contractor.

43

44 **(September 5, 2013)**

45 **Traffic-Signal Controller**

46 Section 9-29.13(3), Item E is supplemented with the following:

47

48 The Unit Chassis that are needed for the 2070E are:

- 49
- 50 Model 2070-1E – CPU module, single board
- 51 Model 2070-2E – Field I/O for 170 cabinet
- 52 Model 2070-3B – Front panel, display B (8 lines of 40 Char.)

Model 2070-4A – Power supply, 10 amp

(April 24, 2013)

Traffic-Signal Controller Software

Section 9-29.13(4) is supplemented with the following:

All 2070E controllers shall operate with the current version of SEPAC controller software.

(September 5, 2013)

Emergency Preemption

Section 9-29.13(6) is supplemented with the following:

Preemption detectors shall be mounted perpendicular to the approach grade of the roadway; within three percent. Two weep holes shall be drilled in the bottom of each detector before it is installed.

Preemption equipment shall be Opticom.

Opticom

The Contractor shall furnish and install the following:

1. Preemption detectors shall be Global Traffic Technologies (GTT) Opticom Model 721.
2. Discriminators shall be GTT four channel Model 764 units.

(September 5, 2013)

Wiring Diagrams

Section 9-29.13(7) is supplemented with the following:

A standard CD or DVD is required. The drawing shall be in AutoCAD Release 2006 or later. Cabinet wiring diagram prints shall not be water soluble.

(September 5, 2013)

Auxiliary Equipment for Type 170E, 2070 Assemblies

Section 9-29.13(10)B, Item D is supplemented with the following:

A TB15 twelve position terminal block of the barrier type rated for 20A at 600 volts RMS minimum and meeting the requirements of Chapter 11 of the Type 170 Hardware Specification, FHWA IP-78-16 as currently amended shall be supplied and mounted on the lower center rear left side wall of the controller side of the cabinet, with an auxiliary pre-emption wiring harness. Wire TB-15 to accept eight auxiliary pre-emption detectors and two inputs from the BPS, and label as shown in the Plans.

Section 9-29.13(10)B, Item G is deleted in its entirety and replaced with the following:

- G. An enclosed detection panel shall be mounted on the inside of the front cabinet door near the top of the door. The detection panel shall have detector switches and LEDs, or high intensity lamps for each field detector input circuit. The lamp shall energize upon vehicle or pedestrian detection, or switch actuation for that circuit. The test switch shall be a three-position switch and be provided with a spring loaded momentary "TEST" position that will place a call on that circuit to the

1 controller, an 'OFF' position that will shut off detection, and an 'ON' position that
2 allows the detector circuit to operate normally. All switches shall have a label
3 adjacent to the switch on which detector circuit or loop number information may be
4 written. A means of disconnecting all wiring entering the panel shall be provided.
5 The disconnect shall include a means to jumper detection calls when the panel is
6 disconnected.

7
8 Section 9-29.13(10)B is supplemented with the following:
9

10 All auxiliary equipment slots shall use nylon guides.

11
12 The alternate (panduct) raceway shall not be allowed.

13
14 The DB-9 socket shall not be installed on the print holder drawer. The cable shall be 6
15 feet long and the DB-9 socket shall be in a protective casing.

16
17 Supplemental loads shall be placed only on the green and yellow outputs of load
18 switches 1, 3, 5, and 7.

19
20 ***\$1\$\$*** mini breakers, one feeder bus, one line lug, and two end caps shall all be
21 mounted on DIN rail and installed in the upper right side of the cabinet with sufficient
22 clearance to allow field wiring to each breaker. Power shall be provided from the TB 1
23 power terminal position 6.

24
25 The sixteen channel 2010ECL RMS conflict monitor shall be capable of logging current
26 and past monitor configurations and the voltage on each output channel at the time of
27 a 'FAILED' state. When the monitor detects a conflicting indication or other condition
28 that causes a monitor 'FAILED' state to occur, the cabinet shall immediately enter flash
29 and stop time. After the conflict monitor has been reset the controller shall immediately
30 take control of the signal displays and resume timing at the beginning of arterial green.

31
32 One PDA-2 power supply shall be provided with one transfer relay and two Model 204
33 flashers installed.

34
35 One Model 420 Auxiliary Output File shall be installed and wired in each 332 controller
36 cabinet. The Auxiliary Output File shall comply with CalTrans TSCES, 1989 edition,
37 and its amendments. The rear terminals shall be permanently labeled as shown on the
38 Plans.

39
40 A neutral bus having at least 20 connection points shall be provided. Two separate
41 buses may be provided if the total number of termination points is greater than 20.

42
43 Two 12 position barrier type terminal blocks shall be installed in the upper rear right
44 side of the cabinet, and shall be labeled "TB-CAM" and "TB-VD".

45
46 One power strip shall be installed and wired with 12 widely spaced outlets (6 front/6
47 rear) and 15A circuit breaker in Double 332 controller cabinet. The power strip shall be
48 designed for standard 19 inch racks (1U high).

49
50 The cabinet auxiliary equipment shall be supplied in the quantities and model numbers
51 shown, and shall be delivered with the cabinet for testing:
52

	<u>Model</u>	<u>Quantity Provided</u>
1	Model 200 Load Switch	***\$2\$***
2	Model 222E 2-Ch. Detectors *	***\$3\$***
3	Model 224E 4-Ch. Detectors	***\$4\$***
4	Model 430 Flash Transfer Relay	***\$5\$***
5	Model 764 4-Ch. Opticom Discriminators	***\$6\$***
6	Model 242 DC Isolator	***\$7\$***
7	Model 252 AC Isolator	***\$8\$***
8	Model 2070E controller	***\$9\$***
9	Model 2070 Master controller	***\$10\$***
10	2010 ECL RMS Conflict Monitor	***\$11\$***
11	Fiber Optic Distribution Panel	***\$12\$***
12	Fiber Optic Splice Tray	***\$13\$***
13	Managed Field Switch	***\$14\$***

All Model 200 load switches shall be optically isolated.

* All Model 222E 2-Ch. Detectors shall conform to the requirements for "Vehicle Detectors" located elsewhere in these Special Provisions.

Except as noted in the following pre-approved list of this section, samples of each item shall be submitted to the Engineer for approval.

Pre-Approved List

GarrettCom 6KQ Managed Field Switch

- 6KQ-24VDC: Base unit with 24V DC power and four (4) 10/100 ports (SLOT A)
- 6KQ4-RJ45: Four (4) 10/100 ports (SLOT B)
- 6KQ-BLANK: Blank cover (SLOT C)
- 6KQ-2GSFP: Two (2) SFP pluggable open transceiver ports (SLOT D)
- SFP-LX10: Gig fiber optic transceiver for SLOT D (Require two (2) units per switch)
- Secure Web Software License

Mini Breakers

- Breaker ABB S201U-K3A
- Breaker SIE5SX2103-7(3A)
- CB feeder bus SIE5ST2142
- Line lug SIE5ST2166
- End cap SIE5ST2155

Power Strip

- Tripp Lite RS1215-RA

Fiber Optic Splicing Kit

- SP12LCUPC: FIS 12 Fiber 900um LC/UPC SM 3 Meter Pigtails

All 2070E controllers shall have C1 configured per the table below.

Pin	I/O	Function	Pin	I/O	Function
1	*****	Logic Ground	53	I-2:7	Not Assigned
2	O-1:1	4P Don't Walk	54	I-2:8	UPS ON BATT

3	O-1:2	4P Walk	55	I-3:1	5 Ext, Calling Count
4	O-1:3	4 Red	56	I-3:2	1 Ext, Calling Count
5	O-1:4	4 Yellow	57	I-3:3	7 Ext, Calling Count
6	O-1:5	4 Green	58	I-3:4	3 Ext, Calling Count
7	O-1:6	3 Red	59	I-3:5	5 Ext, Calling Count
8	O-1:7	3 Yellow	60	I-3:6	1 Ext, Calling Count
9	O-1:8	3 Green	61	I-3:7	7 Ext, Calling Count
10	O-2:1	2P Don't Walk	62	I-3:8	3 Ext, Calling Count
11	O-2:2	2P Walk	63	I-4:5	2 Ext, Calling Count
12	O-2:3	2 Red	64	I-4:6	6 Ext, Calling Count
13	O-2:4	2 Yellow	65	I-4:7	4 Ext, Calling Count
14	*****	Logic Ground	66	I-4:8	8 Ext, Calling Count
15	O-2:5	2 Green	67	I-5:1	Ped 2 Pushbutton
16	O-2:6	1 Red	68	I-5:2	Ped 6 Pushbutton
17	O-2:7	1 Yellow	69	I-5:3	Ped 4 Pushbutton
18	O-2:8	1 Green	70	I-5:4	Ped 8 Pushbutton
19	O-3:1	8P Don't Walk	71	I-5:5	EV-A Preempt
20	O-3:2	8P Walk	72	I-5:6	EV-B Preempt
21	O-3:3	8 Red	73	I-5:7	EV-C Preempt
22	O-3:4	8 Yellow	74	I-5:8	EV-D Preempt
23	O-3:5	8 Green	75	I-6:1	UPS LOW BATT
24	O-3:6	7 Red	76	I-6:2	2 Ext, Calling, Count
25	O-3:7	7 Yellow	77	I-6:3	6 Ext, Calling, Count
26	O-3:8	7 Green	78	I-6:4	4 Ext, Calling, Count
27	O-4:1	6P Don't Walk	79	I-6:5	8 Ext, Calling, Count
28	O-4:2	6P Walk	80	I-6:6	Not Assigned
29	O-4:3	6 Red	81	I-6:7	Flash Sense
30	O-4:4	6 Yellow	82	I-6:8	Stop Time
31	O-4:5	6 Green	83	O-6:1	Not Assigned
32	O-4:6	5 Red	84	O-6:2	Not Assigned
33	O-4:7	5 Yellow	85	O-6:3	OLD Red
34	O-4:8	5 Green	86	O-6:4	OLD Yellow
35	O-5:1	Not Assigned	87	O-6:5	OLD Green
36	O-5:2	Not Assigned	88	O-6:6	OLC Red
37	O-5:3	Not Assigned	89	O-6:7	OLC Yellow
38	O-5:4	Not Assigned	90	O-6:8	OLC Green
39	I-1:1	2 Ext, Calling, Count	91	O-7:1	Not Assigned
40	I-1:2	6 Ext, Calling, Count	92	*****	Logic Ground
41	I-1:3	4 Ext, Calling, Count	93	O-7:2	Not Assigned
42	I-1:4	8 Ext, Calling, Count	94	O-7:3	OLB Red
43	I-1:5	2 Ext, Calling Count	95	O-7:4	OLB Yellow
44	I-1:6	6 Ext, Calling, Count	96	O-7:5	OLB Green
45	I-1:7	4 Ext, Calling, Count	97	O-7:6	OLA Red
46	I-1:8	8 Ext, Calling, Count	98	O-7:7	OLA Yellow
47	I-2:1	2 Calling	99	O-7:8	OLA Green
48	I-2:2	6 Calling	100	O-5:5	Not Assigned
49	I-2:3	4 Calling	101	O-5:6	Flash Output
50	I-2:4	8 Calling	102	O-5:7	Detector Reset
51	I-2:5	RR 1 Preempt	103	O-5:8	Watch Dog Timer

52	I-2:6	RR 2 Preempt	104	*****	Logic Ground
----	-------	--------------	-----	-------	--------------

Controller "C-1" Connector Pin Assignments

(September 5, 2013)

Cabinets for Type 170E and 2070 controllers

Section 9-29.13(10)D, paragraph 1 item 6 is deleted and replaced with:

An incandescent interior cabinet light shall be mounted at the top of the enclosure near the rear door with door switch to automatically energize when the door opens. The light shall be installed a minimum of 12 inches from the vent fan thermostat. The switch shall be labeled "light". 'White' LED 'rope light' cabinet light shall be mounted around the inside of the door frame of each door and wired to the door switch.

Section 9-29.13(10)D is supplemented with the following:

Controller cabinets shall be Model Double 332.

Model 332 cabinet shall be supplied with a Double 332 Cabinet Riser Frame.

Model Double 332 cabinet input file wiring shall be modified to accept "View Com" video monitoring board, as shown in the Plans.

Backup Power Source (BPS)

(November 13, 2008)

The Backup Power Source (BPS) shall be a complete system including all necessary hardware and wiring capable of providing sufficient power to operate the complete traffic signal system for a minimum of two (2) hours of normal operation. The BPS shall be provided with an enclosure, and shall meet these Specifications:

Operation

Output Capacity: minimum of 750W for two hours at 77°F (25°C).

Transfer Time

20ms or less for power transfer and power conditioning. There shall be no noticeable signal display changes for any transfer action.

Line Voltage

Conditioned and Inverted Power: Utility AC power shall be filtered and conditioned.

The BPS AC output shall be 110VAC to 125VAC, 60Hz ± 0.3 Hz, true sine wave.

The BPS shall incorporate lightning and surge suppression compliant with ANSI/IEEE C.62.41

Batteries

Batteries shall be AGM/VRLA (Absorbed Glass Mat, Valve Regulated Lead Acid).

Battery connections shall be 50-amp connectors.

1 Individual batteries shall not weigh over 50 pounds.
2
3 Batteries shall be certified by the manufacturer to operate at between -4°F (-20°C)
4 and 140°F (60°C).
5
6 The battery system shall be protected by a fuse or a circuit breaker with the
7 appropriate rating for the system as configured. If fused, at least two spare fuses
8 shall be included.
9
10 **Charging System**
11 The charging system shall be compatibly sized and controlled for the battery units
12 as supplied and configured for the BPS system and shall fully recharge the
13 batteries from protective cutoff to 85% charge in 20 hours or less.
14
15 **Electrical**
16 The BPS shall incorporate a bypass switch. The bypass switch shall completely
17 isolate the BPS controller/inverter and batteries from utility AC power and the traffic
18 signal controller with no disruption of AC power to the traffic signal controller. The
19 bypass switch shall be clearly marked.
20
21 The BPS shall incorporate electrical connectors and disconnects such that the
22 controller/inverter unit and batteries may be removed for service with no interruption
23 in utility AC power to the signal controller. All power terminal and alarm connections
24 shall be accessible for service without the removal of the batteries or the controller/
25 inverter unit.
26
27 **Controls and Displays**
28 The BPS shall include operating indicators showing status of input and output
29 power, charger state, battery charge condition, event counter, and an hour meter
30 showing the total number of hours the unit has operated on off-line battery power.
31
32 All controls and switches shall be clearly labeled and easily accessible.
33
34 **Enclosure**
35 The inverter/controller unit for the BPS system shall be housed in the Double 332
36 cabinet. Fixed or rollout shelves, or hinged or swing-out trays may be provided for
37 the batteries in the battery cabinet attached to the Double 332 cabinet. All batteries
38 shall be secured to their respective shelf or tray.
39
40 **Additional Features**
41 A minimum of two form C relays shall be provided to signal alarms for a minimum of
42 two different conditions including either: utility AC power failure, system low battery
43 charge warning, or 'long' outage duration under BPS power (power loss event
44 initiated timer relay adjustable from 0 to 120 min). Relays and timers shall be
45 clearly labeled and provided with terminal blocks. Contacts shall be rated for
46 120VAC 10A.
47
48 A DB-9 serial communication port shall be provided for configuring the BPS and for
49 BPS status reporting.
50
51 The cabinet shall have a 120 VAC, 30 AMP transient voltage protection device.
52

1 **Documentation**

2 Manufacturer's documentation shall be provided and shall include schematics,
3 spare parts lists, manuals, and appropriate system/controller settings. A full
4 schematic of the BPS cabinet wiring shall be provided.

5
6 **Warranty**

7 A two (2) year warranty shall be provided for the BPS and batteries.

8
9 **Training and Setup**

10 The supplier of the BPS shall provide at least one hour of on-site (Snohomish
11 County Signal Shop) training to personnel of the Contracting Agency in the setup,
12 operation, troubleshooting, and maintenance of the BPS. Written material covering
13 the operation of the BPS shall be presented. A trained factory representative shall
14 do the initial setup of the unit as delivered for shop function testing and shall be
15 present at field turn on to verify correct installation and operation.

16
17 **Testing**

18 Approved units shall be delivered to the Signal Shop for specification conformance
19 checks and function testing at the same time as controllers. After field installation,
20 the Contractor shall test the completed BPS and demonstrate that the BPS is
21 capable of supplying backup power to the traffic signal system. The test procedure
22 shall be to turn the 'signal' breaker in the service cabinet off, verify that the BPS
23 supplies battery inverted power to the traffic signal and that the traffic signal
24 operates normally with no noticeable interruption, then restore power by turning the
25 'signal' breaker back on and verifying that the BPS returns to utility AC power with
26 no noticeable interruption in signal operation. This test shall be performed at least
27 twice in the presence of the Engineer. The test shall not be performed with the
28 signal controller flashing, the signal controller shall be operating normally.

29
30 Except as noted in the following pre-approved list of this Section, samples of each
31 item shall be submitted to the Engineer for approval.

32
33 The submittal will include one complete, functional cabinet unit conforming to the
34 Contract Plans, these Contract Specifications and the Standard Specifications for
35 examination and testing. The submittal will include the full set of required
36 schematics, cabinet wiring diagrams, manufacturer's documentation, recommended
37 operating parameter settings and procedures, and parts list. Battery cut sheets
38 shall be provided and shall include the weight, battery construction type, recharge
39 settings, and amp hour capacity (AH).

40
41 **Pre-Approved List**

- 42
43 1. Clary Corporation SP-1000 with Clary Outpost 1241 batteries and fast
44 recharge option, PIM (Power Interface Module) 30G with generator plug
45 (30A rated).
46 2. Innovative Technology model HS-120-30A transient voltage protection
47 device.
48 3. 50-amp Anderson connectors.

49
50 **Vehicular Signal Heads, Displays, and Housing**

Conventional Traffic Signal Heads

(May 12, 2014)

Optical Units

Section 9-29.16(2)A is supplemented with the following:

LED traffic signal modules shall have the same appearance as incandescent displays, except Bimodal Arrow signal modules, which may provide an outline appearance.

Except as noted in the following pre-approved list of this section, samples of each type of LED traffic signal module shall be submitted to the Engineer for approval. Submittals shall include a copy of a test report certified by an independent laboratory that the LED traffic signal module submitted meets I.T.E. Standards for light distribution, chromaticity, and power (consumption, power factor and harmonic distortion). Submittals shall also include two modules of each type to be supplied for shop evaluation.

Pre-Approved List

Dialight product numbers 433-2220-001XL15, 433-1210-003XL15, 433-3230-901XL15, 432-2324-001XOD15, 432-1314-001XOD15, 431-3334-901XOD15, 430-6479-001X, P46-3R33-003, P46-3Y33-003, and P46-3G33-003.

WARRANTY

The LED traffic signal module shall be warranted against any failure due to workmanship, material defects or intensity within the first 60 months of field operation. The LED traffic signal module shall meet or exceed minimum luminous intensity values during the 60 months of field operation.

Replacement LED signal modules shall be provided within 5 days after receipt of failed LED signal modules at no cost to the Contracting Agency, except the cost of shipping the failed modules.

Signal Housing

(September 19, 2013)

Section 9-29.16(2)B is supplemented with the following:

Each traffic signal section shall have two downward facing weep holes drilled in the bottom horizontal surface of the housing. Weep holes shall be 3/16" in diameter in two opposite corners and shall not be blocked by any obstructions. No internal feature is to be damaged when the weep holes are drilled.

Back Plates

(May 14, 2012)

Back plates shall be furnished and attached to the signal heads. Back plates shall be 5 inches wide ABS or polycarbonate, flat black on both sides.

Two (2) inches wide Type 4 prismatic reflective 3M yellow tape shall be installed around the exterior edge of the plate.

Signal Head Mounting Brackets and Fittings

(September 19, 2013)

Section 9-29.17 is supplemented with the following:

Type A, B, H, and K terminal compartments shall have a single weep hole in the bottom. Weep holes shall be 3/16" in diameter and shall not be blocked by any obstructions. No internal feature is to be damaged when the weep holes are drilled.

Vehicle Detector

(April 5, 2013)

Section 9-29.18 is supplemented with the following:

Video Detection

The Video Detection System shall consist of TRAFICON video detection equipment, auxiliary equipment, cameras, housings, and mounts, and all required mounting hardware, cables, connectors, and wiring. The video detection equipment shall be of the quantities shown, and shall be delivered to the Snohomish County Public Works Cathcart Maintenance Center (PWCMC) with the controller cabinet for testing.

	Model	Quantity Provided
1	Video Detection Board: TRAFICON VIP 3D.2	\$\$1\$\$
2	Video Detection Board: TRAFICON VIP 3D.1	\$\$2\$\$
3	TRAFICON 4-I/O Expansion Board	\$\$3\$\$
4	TRAFICON 2-I/O Expansion Board	\$\$4\$\$
5	Keypad for programming Video Detection Board	\$\$5\$\$
6	Monitor for programming Video Detection Board	\$\$6\$\$
7	TRAFICON VIEWCOM/E MAXs Remote Monitoring Board	\$\$7\$\$
8	FLIR 9 mm Thermal Traffic Detection Camera	\$\$8\$\$
9	FLIR 13 mm Thermal Traffic Detection Camera	\$\$9\$\$
10	FLIR 19 mm Thermal Traffic Detection Camera	\$\$10\$\$
11	Rainbow Camera and Lens complete in Housing	\$\$11\$\$

Camera and Housing Assembly: Focus free thermal traffic detection camera or high resolution 1/3" image format Color CCD camera with a motorized zoom auto-iris lens, installed and wired in an aluminum weatherproof housing. The power, video, and lens control wiring shall be provided and be pre-wired to the power supply, camera, and lens. The wires shall be unterminated.

Camera Mounting: Pelco Astro-Brac Extended Tilt & Pan mount, part AB-0169 with cable mount and 72 inch tube. The cable mount shall be suitable for the mast arm diameter at each camera installation location.

Camera and Lens: FLIR FC-Series T, Rainbow CLD54, or equivalent approved by the Engineer meeting these minimum Specifications:

FLIR FC-Series T

Array Format (NTSC)	320 x 240
---------------------	-----------

Detector Type	Uncooled VOx Microbolometer; w/10-year Warranty
Effective Resolution	76,800
Pixel Pitch	25 µm
Field of View (Focal Length)	48° x 37° (FC-348t; 9 mm) 34° x 26° (FC-334t; 13 mm) 24° x 18° (FC-324t; 19 mm)
Spectral Range	7.5 µm to 13.5 µm
Lens	Athermalized, focus-free

Housing: Extruded aluminum weatherproof housing suitable for the above camera, having an integral power transformer for the camera and meeting these Specifications:

Rating:	IP 66
Input Voltage	90-240 VAC single phase 50-60 Hz
Power Consumption	1.7 W nominal at 110 VAC 18 W peak w/heaters
Operating Temperature Range	-58°F to 167°F (continuous operation) -40°F to 167°F (cold start)
Storage Temperature Range	-67°F to 185°F
Humidity	0-95% relative
Shock	MIL-STD-810F "Transportation"
Vibration	10g shock pulse with a 11ms half-sine profile
Cable Entry:	Liquid-tight strain relieved fitting suitable for the cable provided with the camera assembly
Mounting	Two ¼-20" threaded holes, 1" spacing along centerline front to back
Sunshield	Provided

Rainbow CLD54

Image Sensor	1/3" Interline Transfer Sony Super II HAD CCD
TV System	NTSC
Picture Elements (pixels)	768 (H) x 494 (V)
Horizontal Resolution	540 TV Lines
Minimum Illumination	0.1lux
Signal to Noise	More than 48dB
Sync System	Internal
Video Output	1 Vp-p 75ohm
Auto-Iris Drive	DC or Video Type (4-pin square connector)
White Balance	ATW/AWC/Manual
Electronic Iris	1/60 – 1/100,00 – On/Off Selectable
BLC (Backlight Compensation)	On/Off Selectable (Standard and Wide Dynamic)
AGC (Automatic Gain Control)	0-18-24-32dB Selectable
Day/Night Function	Color/B&W/Auto

Power Requirement	12VDC/24VDC ±20%, 250mA Max
Operating Condition	+14° ~ 122°F within 85% RH
Included Accessories	CS/C mount adapter, 4-pin iris connector

Lens: Rainbow L10X65DC4P/CS or equivalent meeting these minimum Specifications:

Focal Length	6.5~65mm
Field of View	6.5mm: 40.5° x 31.0°
	65mm: 4.2° x 3.2°
Back Focal Distance	9.85mm
Iris:	F1.4~Approx. F360 with ND Spot Filter
Zoom:	Motorized
Focus	Motorized
Mount:	CS/C
Filter Size	43mm PO.75

Housing: Extruded aluminum weatherproof housing suitable for the above camera and lens, and having an integral power transformer for the camera and the defogger, meeting these Specifications:

Rating:	NEMA 4
Power - IN:	108 to 132 VAC
Power – OUT to camera	24VAC
Window:	1/8" glass with integral thermostatically controlled 10 watt heater
Cable Entry:	Liquid-tight strain relieved fitting suitable for the cable provided with the camera assembly
Mounting	Three ¼-20 threaded holes
Sunshield	Provided

Wiring:

Video/Power/Lens control:	6-Conductor dual-element conforming to the Specification given above in the supplement to 9-29.3.
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Surge Suppression: Each camera assembly shall have a surge suppressor which shall be installed inside the traffic signal controller cabinet. The surge suppressor shall be an EDCO CX06-BNCY, or equivalent meeting these Specifications:

Peak Surge Current	5Ka
Technology	Hybrid, Solid State
Attenuation	0.1dB @ 10 Mhz
Response Time	<1 nanosecond
Protection	Line to Ground
Clamp Voltage	6 V
Connectors	BNC
Impedance	75 ohms
Environmental	-40°F to 185°F
Mechanical	4½" x 1½" x 1¼"

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Installation

The Contractor shall install the video cameras and wiring to the cabinet, and make all necessary connections. The cameras shall be picked up for installation at the same time as the controller cabinet.

The product supplier of the video detection system shall supervise the installation and testing of the video equipment. A factory certified representative from the manufacturer shall be on-site during installation. The factory representative shall install, make fully operational, and test the system as indicated on the Plans and this Specification.

Video Cable Connectors

(September 19, 2013)

All RG-59 video cable connections shall be CP-88-2 and CP-89-2T.

Induction Loop Detectors

(March 26, 2009)

Section 9-29.18(1) is supplemented with the following:

The induction loop detectors shall be capable of loop fault diagnostics, shall be self-tuning for inductances from 20 to 2500 microhenries with a Q factor of 5, and have a minimum of 15 sensitivity level settings.

Except as noted in the following pre-approved list of this section, samples of each type of induction loop detector shall be submitted to the Engineer for approval.

Pre-approved list:

- 1. Global Traffic Technologies Canoga C922
- 2. Eberle Design LM602
- 3. Eberle Design Oracle 2E

Pedestrian Push Buttons

(September 19, 2013)

Section 9-29.19 is supplemented with the following:

The push button switch assembly shall be mounted with the terminal connections up.

Pedestrian Signals

(April 17, 2009)

Section 9-29.20 is supplemented with the following:

The pedestrian signal shall be hand/man with countdown.

The optical unit shall be LED. The pedestrian signal head housing shall be die-cast aluminum.

The LED displays shall be warranted against defects in materials and workmanship for a period of five years from the date of installation.

1 The hand and man and countdown symbols shall have a uniform appearance; individual
2 LEDs shall not be visible. The hand and man symbols shall be on the left side
3 superimposed and the countdown symbol on the right side.
4

5 Except as noted in the following pre-approved list of this section, samples of each item
6 shall be submitted to the Engineer for approval.
7

8 Pre-approved list:

- 9 • Dialight product number 430-6479-001X
10

11 **Weep Holes**

12 Each pedestrian signal head shall have one downward-facing weep hole drilled in the
13 bottom horizontal surface of the housing. Weep holes shall be 3/16" in diameter and
14 shall not be blocked by any obstructions. No part of the housing or display is to be
15 damaged when the weep holes are drilled.
16

17 **Accessible Pedestrian Signal (APS)**

18 (May 12, 2014)

19 Section 9-29.20 is supplemented with the following:
20

21 Housings shall be die-cast aluminum and shall be painted with two coats of factory
22 applied traffic signal yellow.
23

24 Audible Pedestrian Indicators shall have an audible speaker, call confirmation LED,
25 and vibrotactile arrow. The audible speaker shall be programmable to have a button
26 locator tone, acknowledgment tone/message, walk cycle tone/message, and
27 clearance tone/message. The unit(s) shall have automatic volume controls for
28 message strength over ambient noise. The walk tone/message shall be
29 programmable to stop with walk signal or user settable time. The device shall be
30 user settable for APS message initiation with an extended press or on call. The
31 controller unit shall be installed in the signal cabinet. The pedestrian button/sign
32 housing shall be traffic signal yellow. The device shall provide a pedestrian call
33 contact closure duration suitable for operation with a NEMA Model 332 cabinet.
34

35 Pre-approved list:

- 36 • Polara EZCommunicator 2-wire Navigator APS System, with Option T
37 (9"x15") countdown sign, braille text, and custom voice message (Part
38 number EN29TB1-Y).
39

40 **Service Cabinets**

41 (September 5, 2013)

42 Section 9-29.24, Item I is deleted in its entirety and replaced with the following:
43

- 44 I. All service enclosures shall be fabricated of 0.125 inch (minimum) 5052 alloy
45 aluminum H32 ASTM designator or B209 aluminum.
46

47 **Amplifier, Transformer, and Terminal Cabinets**

48 (September 6, 2012)

49 Section 9-29.25, Item 1, is revised to read as follows:
50

- 51 1. All cabinets shall be constructed of welded 14 gage, minimum Type 316 stainless
52 steel or 0.125 inch minimum 5052 alloy aluminum H32 ASTM designator minimum.

Line a. of Item 2 is deleted and replaced with the following:

- a. Battery Depth 8", Height 27", Width 24"

Section 9-29.25 is supplemented with the following:

11. Terminal blocks shall only be added to a backplane standoff panel mounted to the back of the cabinet. No sidemounted terminal strips shall be permitted.
12. The battery cabinet shall be bolted securely to the right side of the controller cabinet when facing the front of the cabinet with 4-1/2 inch bolts, liquid tight seals, flat and lock washers, and nuts. The cabinet shall have a louvered vent, filter, and thermostatically controlled fan. The battery shelves or trays may be fixed or hinged, and the batteries secured. The entry between the battery and controller shall be two 1 inch liquid tight fittings.
13. Terminal cabinets shall have one 12 position terminal block that has the following pairs of vehicle/pedestrian phases (2/8, 4/2, 6/4, and 8/6). These terminal blocks shall have one each: 180, 135, and 90 degree male terminal extenders placed on rows 1, 2, 3, 5, and 12.
14. Terminal Cabinets dimensions shall be 8"D x 24"H x 18"W.

Closed Circuit Television (CCTV) System

(January 28, 2014)

Each CCTV system shall be suitable for placement outdoors.

The CCTV system shall be on the QPL or a certificate of compliance shall be submitted by the manufacturer. The certification shall state that the CCTV system meets the following requirements.

CCTV System

The discreet CCTV camera dome system shall have a clear lower dome and varifocal, auto iris lens.

The indoor/outdoor CCTV camera dome system shall meet or exceed the following design and performance specifications:

Camera Specifications

Sensor Type	1/2.8-inch Type Exmor CMOS
Optical Zoom	30X
Digital Zoom	12X
Maximum Resolution	1920 x 1080
Lens	f/1.6~f/3.5, focal length, 4.7 mm (wide)~94.6 mm (tele)
Horizontal Angle of View	55.4°(wide)~2.9°(tele)
Aspect Ratios	16:9
Light Sensitivity	f/1.6; 28dB gain at 30 IRE
Color (33 ms)	0.65 lux
Color (250 ms)	0.07 lux

1	Mono (33 ms)	0.20 lux
2	Mono (250 ms)	0.015 lux
3	Day/Night Capabilities	Yes
4	IR Cut Filter	Yes
5	IR Trace	Curves 850nm and 950 nm
6	Wide Dynamic Range	80 dB
7	Iris Control	Auto iris with manual override
8	Backlight Compensation	Yes
9	Operating Temperature	-22°F to 122°F
10	Pan Angel	360° continuous rotation
11	Pan Speed	280°/sec
12	Tilt Angel	+1° to -90°
13	Tilt Speed	160°/sec
14	Port	RJ-45 connector for 100Base-TX

15

16 **Dome Mount**

17 The dome mount shall be a pendant type with a pole mount adapter and shall consist of a
 18 medium duty mount designed specifically for mounting the pendant domes to a pole along
 19 with any accessories which may be required for a complete dome mount. The dome mount
 20 shall meet or exceed the following design and performance specifications and shall be:

21

- 22 • capable of supporting up to 75 lbs.
- 23 • versatile in that it may be mounted directly to a wall or adapted to a parapet,
 24 corner or pole when used with the proper optional adapter.
- 25 • constructed of cast aluminum and finished in gray polyester powder coat.
- 26 • featured with an integral 120/230VAC to 24VAC, 50/60 Hz, 100va transformer to
- 27 • power all environmental and dome functions.
- 28 • featured with selectable input power via a slide switch.
- 29 • designed with a front access cover plate for the transformer.
- 30 • designed with transformer that shall be fused with one, 1.6A, 120VAC fast acting
- 31 fuse and one, 500mA, 230VAC fast acting fuse.
- 32 • capable of cable access either through the arm from openings in the mounting
- 33 plate or .75" conduit fittings may be drilled on either side of the mount. Drill starts
 34 (dimples) shall be designed into the mount, one on either side for conduit hole
 35 location.
- 36 • designed with cable feed-through.
- 37 • mounted to a solid surface via four 3/8" fasteners suitable for the mounting
 38 surface.

39

40 The dome mount shall be provided with a manufacturer's warranty covering repair or
 41 replacement of defective parts for a period of one year from the date of shipment.

42

	<u>Model</u>	<u>Quantity Provided</u>
1	19" Flat Panel LCD, Monitor 3.3" D x 16.6" W x 14.7" H	\$\$1\$\$
2	CCTV, Camera Dome System	\$\$2\$\$

43

44 Except as noted in the following pre-approved list of this section, samples of each item shall
 45 be submitted to the Engineer for approval.

46

47 **Pre-Approved List**

48

- Pelco 400 Series LCD Monitor (PMCL419)

- 1 • Pelco Spectra HD (S5230-EG0) Dome Outdoor Camera with IWM24-GY and PA402
- 2 Mount
- 3
- 4 **CCTV Cable**
- 5 Siamese composite cable shall consist of four video/control unshielded twisted pairs with 23
- 6 AWG solid bare copper conductors that test to Category 5e. The power pair shall consist of
- 7 16 AWG stranded conductor.
- 8
- 9 Pre-approved list:
- 10 • Belden Siamese Cat 5e Tested (5288US)
- 11